2 in Ark.; and on 1 in Ill., Iowa, Kans., Ky., Mo., and N. H. West of the Rocky Mountains thunder-storms were reported as follows: Ariz., 5th, 30th, and 31st; Cal., 3d; Nev., 29th and 30th; Oregon, 14th and 19th; Utah, 30th; Wash., 13th and 18th. In states and territories other than those named no thunder-storms were reported.

MISCELLANEOUS PHENOMENA.

DROUGHT.

Drought prevailed in parts of Illinois, Iowa, Missouri, Louisiana, Texas, and Montana. At Philo, Ill., only 0.13 inch of rain had fallen from November 16th to December 31st, and water was very scarce. At Fort Madison, Iowa, the month was very dry. At Cedar Rapids, Iowa, the monthly precipitation was the smallest for December during the last 5 years; the river was quite low, and streams and wells were becoming dry. At Oregon, Mo., water was failing in streams and springs. At Hannibal, Mo., it was the driest month of the year, and the river was reported lower than at any time in 50 years. At Shelbina, Mo., no precipitation fell from November 16th until December 31st, and wells and stock ponds were unusually low. The drought that prevailed in north Louisiana from November 16th was broken on the 5th, and in south Louisiana on the 3d. Near San Antonio, Tex., scarcity of water on the ranges caused large loss of live stock; the drought was broken on the 23d. Near Fort Custer, Mont., many streams were dried up, and stock was suffering for water.

MIRAGE.

On the 14th, at Saint Vincent, Minn., the Pembina Mountains, 50 miles distant, and Hamilton, N. Dak., 22 miles distant, were in full view at 8 a. m., 75th meridian time. At this time a remarkably fine mirage was observed. Objects, large and small, were plainly brought to view. Smoke from chimneys many miles away could be distinctly seen, and cattle in a farm-yard, 8 miles distant, were plainly visible. The phenomenon lasted from daybreak until 9.45 a. m. On the 20th a mirage was observed at Ship Island Light-house, Miss., between 3 and 4 p. m., Biloxi, Miss., and vessels and bathing-houses being clearly seen.

SUN SPOTS.

Mr. D. E. Hadden, Alta, Iowa: 3d, 1 group, 1 spot; large spot on nw. limb, disappearing by solar rotation. 7th, small faculæ on nw. limb; faint groups faculæ near e. and sw. limbs. 12th, small faculæ near e. limb. 14th, 2 groups, 10 spots; larger groups s. latitude on meridian; other group e. one-fourth across disc; small faculæ near se. limb. 15th, 3 groups, 14 spots, definition poor. 16th, 2 groups, definition poor. 17th, 1 group, definition poor. 18th, 2 groups, 8 spots; large group of 5 spots near sw. limb, surrounded by faculæ; the other group 1 day east of meridian. 19th, 2 groups, 10 spots; new spots in group on meridian. 20th, 3 groups, 5 spots; 1 group on w. limb, disappearing by solar rotation, had brilliant faculæ, but spots could not be seen; new group on e. limb with large areas of faculæ. 21st, group which was near meridian n. latitude 20th had disappeared, and the group visible on e. limb 20th could not be seen; small faculæ e. 23d, faculæ w. and sw. 26th, 1 group, 2 spots; new group n. latitude 1 day e. of meridian. 27th, 1 group, 1 spot; spot on meridian vanishing. 28th, small faculæ by rotation on e. limb. 29th, 1 group, 1 spot; new group in faculæ near e. limb; faculæ nw. Cloudy 1st, 2d, 4th, 5th, 13th, 24th, and 31st.

Mr. C. E. Buzzell, Leaf River, Ill.: 1st, the large disturbance of November 21st was passing w. limb. 2d to 7th, cloudy. 8th, marked faculæ and small spots near w. limb. 9th to 12th, poor definition. 13th, poor definition; 1 group, 2 days in, in n. latitude; 1 group, 5 days in, in s. latitude; both unchanged on 14th. 15th and 16th, cloudy. 18th, 1 new group near meridian; 1 group near w. limb, which faded out on 19th. Group of 18th subsided on 20th, with apparent clear disc on 21st. 25th, 2 small groups in n. latitude near meridian; faded out on 28th. 29th, new group, 3 days in, in n. latitude; faded out on 30th. 31st, cloudy.

Mr. John W. James, Riley, Ill.: the large spot on the sun's meridian November 28th disappeared by solar rotation 4th, but failed to reappear when due on e. edge. 4th to 13th, none seen. 14th, a group of 12 small spots on sun's meridian in very low s. latitude; still seen 18th. 21st, faculæ near e. limb. 21st to 28th, no spots seen. 29th, 1 small spot, surrounded by faculæ, 2 days from e. edge; spot gone on 30th.

Mr. H. D. Gowey, North Lewisburgh, Ohio: sun spots were observed on the 2d, 14th, 15th, 18th, and 19th.

Haverford College Observatory, Pa. (observed by Prof. F. P. Leavenworth):

Date.	Number of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculæ.	Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	
Dec., 1890.										
1, 10 a. m...	1	1	0	0	0	0	3	13	2	Definition fair; 2 large spots.
2, 11 a. m...	0	0	0	0	0	0	2	8	1	Definition good; 1 large spot.
4, 11 a. m...	0	0	1	3	0	0	0	0	2	Definition fair.
9, 2 p. m...	1	4	0	0	0	0	1	4	1	Definition good.
10, 10 a. m...	1	3	1	4	0	0	1	3	1	Definition good; spots small.
11, 11 a. m...	0	0	0	0	0	0	1	2	1	Definition good; spots small.
12, 11 a. m...	0	0	0	0	0	0	0	0	0	Definition poor.
13, 11 a. m...	2	15	0	0	0	0	2	15	2	Definition fair.
14, 12 m.....	0	17	0	0	0	0	2	32	1	Definition fair.
15, 9 a. m...	0	0	0	0	0	0	2	32	2	Definition fair.
18, 3 p. m...	0	0	0	0	0	0	2	21	0	Definition bad.
19, 10 a. m...	1	1	0	0	1	1?	3	24	2	Definition poor; 1 large spot.
20, 1 p. m...	0	19	0	0	0	0	3	31	2	Definition good.
22, 10 a. m...	0	0	1	4	0	0	0	0	1	Definition fair.
23, 10 a. m...	1	2	0	0	0	0	1	2	2	Definition poor.
24, 10 a. m...	0	4	0	0	0	0	1	6	2	Definition poor.

VERIFICATIONS.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

FORECASTS FOR 48 AND 72 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer has authorized forecasts for 48 and 72 hours, covering the 2d and 3d days in advance. These are optional with the forecast official, and are only made when clearly in the public interest, and cover, in all cases, considerable areas of country, and are not confined to localities.

Percentages of verifications of forecasts made for second day in advance. Number of predictions made: weather, 243; temperature, 158. Percentages of verifications: weather, 84.1; temperature, 94.4; weather and temperature combined, 87.5.

Percentages of verifications of forecasts made for third day in advance. Number of predictions made: weather, 25. Percentage of verifications: weather, 96.

FORECASTS FOR 24 HOURS IN ADVANCE.

The forecasts for districts east of the Rocky Mountains for December, 1890, were made by Captain James Allen, 3d Cav-